

### 5.3 Imitation or artificial pearls

To replace actual or cultured pearls, imitation pearls are prepared by applying tough, round bases, with materials that mimic the qualities of pearls. The coating may show a difference in response to inexpensive glittering paints, imitated pearl essences crafted of fish scales, and so on. The artificial pearls leave a trace on their smooth surface when pressed against a sharp object in contrast to natural or cultivated pearls (Alexander and Kumar Verma, 2023) (Figure 1).

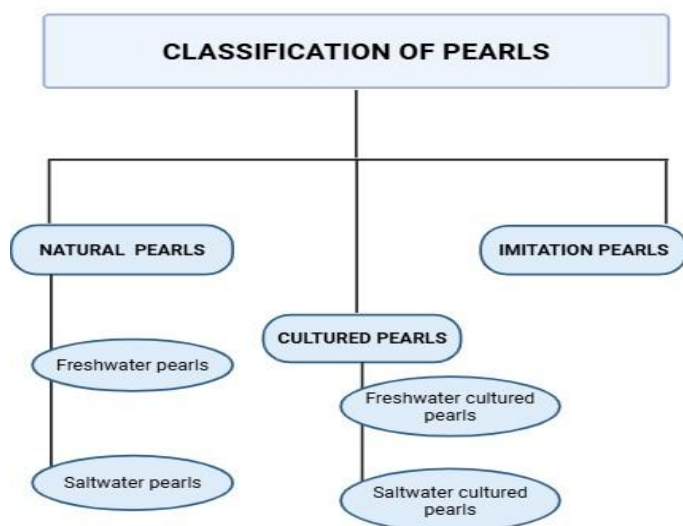


Figure 1 Classification of pearls

## 6 Biological and Technological Aspects

The pearls are formed by placing an irritant, usually a tiny bead or tissue lining, surgically into the mollusc into which the nacre is embedded to form the pearl in a few months to years (Saurabh et al., 2022). It is of paramount importance to maintain optimal water quality because physiological stress caused by such factors as ammonia may negatively influence the state of mussels and the quality of pearls. As an example, high levels of ammonia may disrupt important enzyme functions and antioxidation defences in *Lamellidens marginalis*, proving that the quality of water is reviewed and managed to ensure sustainable pearl culture (Chhandaprajnadarsini et al., 2025).

In order to facilitate operational efficiency, smart monitoring systems adoptions, including the use of IoT-enabled water quality sensors, application of machine learning models to predict the environment, etc. have become increasingly prevalent. Such technologies are able to forecast variations in such parameters as dissolved oxygen and pH to allow farmers to make appropriate interventions in time (Singh et al., 2022).

As part of its survival mechanisms, the marine oysters (particularly, *Pinctada spp.*) rely on their in-built immunity or an immune system to counter the environmental pressures like changes in temperature, salinity, the presence of pathogens and pollutants, etc. Antimicrobial peptides, lectins, heat shock proteins, and antioxidant enzymes are activated within them to sustain the cellular homeostasis. The pearl oyster can survive in unpredictable marine conditions with this capability. However, severe stress system may undermine the immunity of oysters and quality of pearls (Adzigbli et al., 2020).

## 7 Freshwater Pearl Culture

Pearl farming in freshwater involves the following steps sequentially:

### 7.1 Collection of mussels

The freshwater bodies have the mussels cleared manually and then transported to farm where they are harvested in a healthy manner. The habitats are primarily submerged in shallow peripheral regions and are primarily concealed